Developing our urban forests in changing cities

11/11/2021

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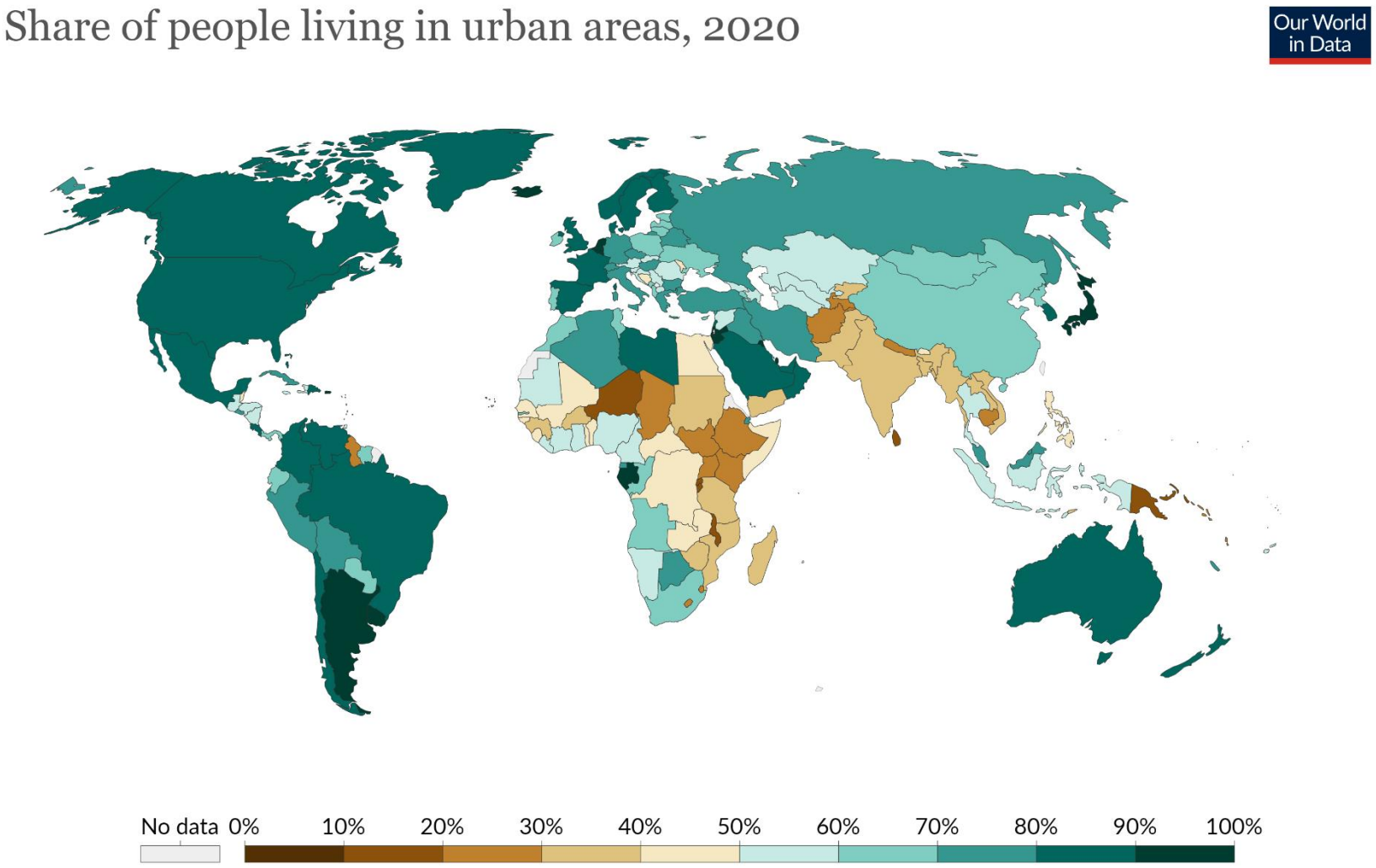
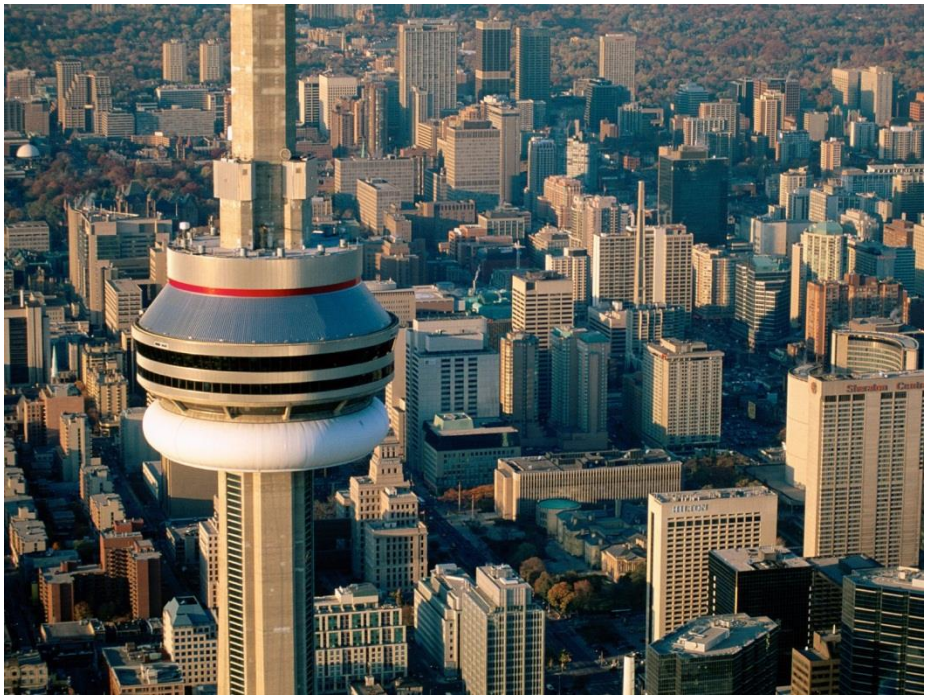
Global Urbanisation



The Developing City



- Redevelopment is a journey, not a destination
  - Amalgamation or subdivision of existing property boundaries
  - Replacement of aging buildings with newer, larger buildings
  - Usually leads to densification or intensification

Urbanisation and Development in NZ

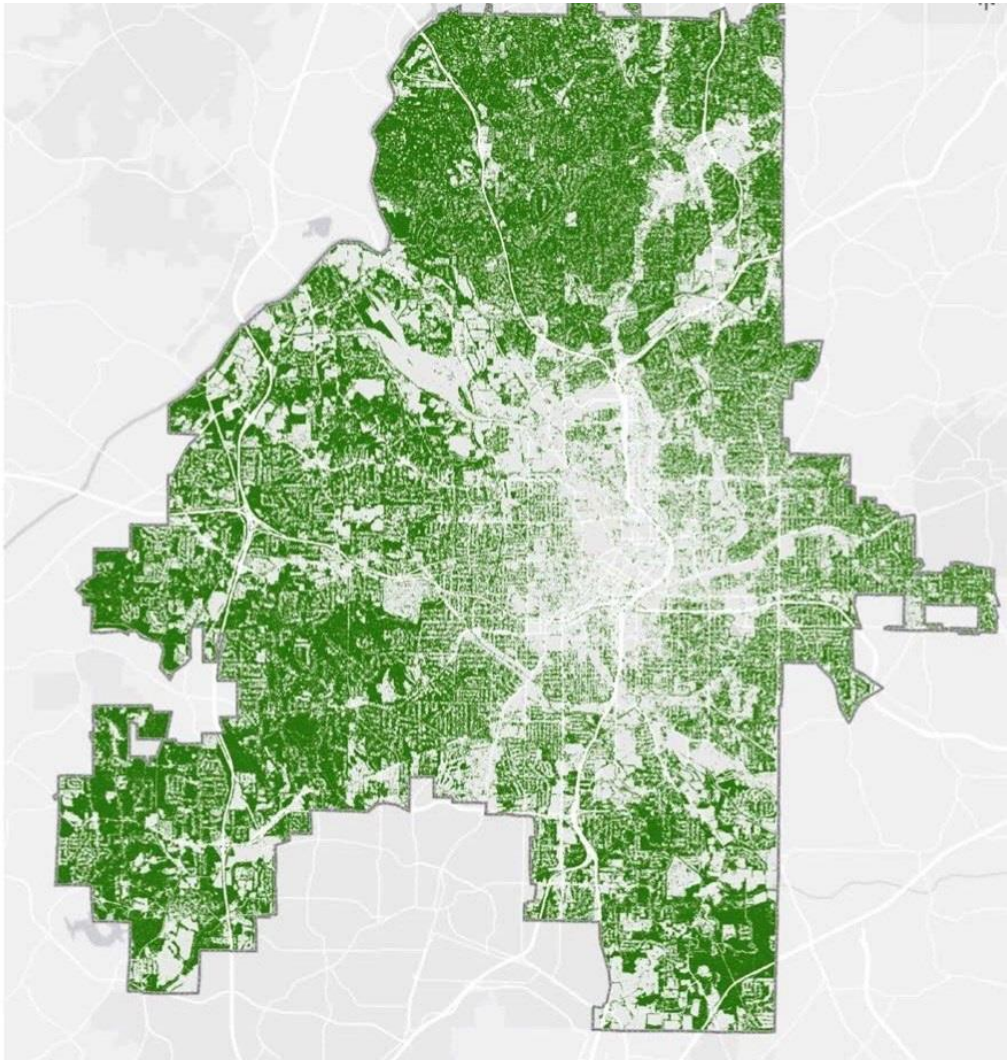
- New intensification rules allow buildings of up to three storeys on most sites in cities without resource consent

- National Policy Statement on Urban Development stops councils hindering development by banning height limits of less than six storeys and car parking requirements in urban areas
- Are we developing trees/greenspaces out of our cities?

Urbanisation and the Urban Forest

Urban-rural gradient studies show decline in tree canopy cover moving from rural fringe to urban core

'Green donut' effect



Development's Effect on the UF

Canopy cover studies link tree cover loss with densification, impermeable surfaces…

But what's happening at the parcel scale? And can that knowledge help us make better regulations and incentives to protect UF?

Addressing the Knowledge Gap

- What happens to trees on a property when it is (re)developed
- Why are trees removed or retained during (re)development?

Urban Forestry & Urban Greening 35 (2018) 192–201

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug

Redeveloping the urban forest: The effect of redevelopment and property-scale variables on tree removal and retention

Tingdong Guo[a], Justin Morgenroth[a,*], Tenley Conway[b]

Applied Geography 82 (2017) 1–10

Contents lists available at ScienceDirect

Applied Geography

journal homepage: www.elsevier.com/locate/apgeog

Redevelopment and the urban forest: A study of tree removal and retention during demolition activities

Justin Morgenroth [a, *], Jarlath O'Neil-Dunne [b], Luis A. Apiolaza [a]

Sustainable Cities and Society 56 (2020) 102096

Contents lists available at ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Patterns of tree removal and canopy change on public and private land in the City of Melbourne

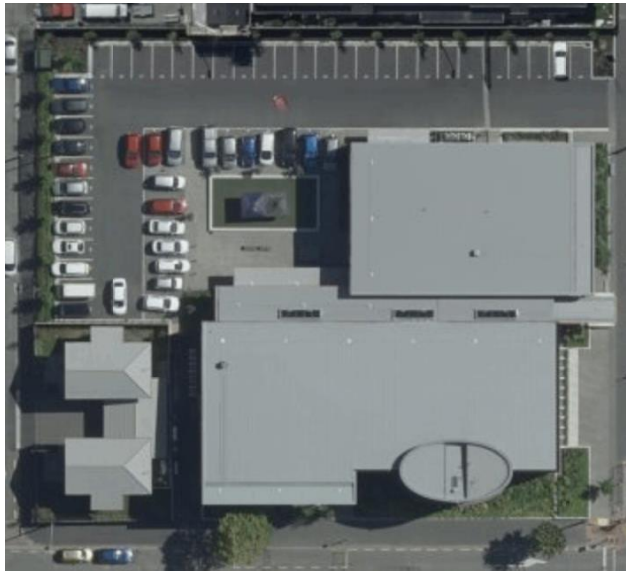
Thami Croeser[a,b,*], Camilo Ordóñez[b], Caragh Threlfall[b], Dave Kendal[b,c], Rodney van der Ree[b,d], David Callow[e], Stephen J. Livesley[b]

Low- and medium-density residential

Major private developments

Methods

- Before/after approach to measure effect of redevelopment on tree removal/retention
- Done at the property level, rather than city level



Methods

- Manual delineation of trees using aerial imagery and LiDAR data
- 450 residential properties in Christchurch, NZ
  - 321 redeveloped, 129 non-redeveloped properties

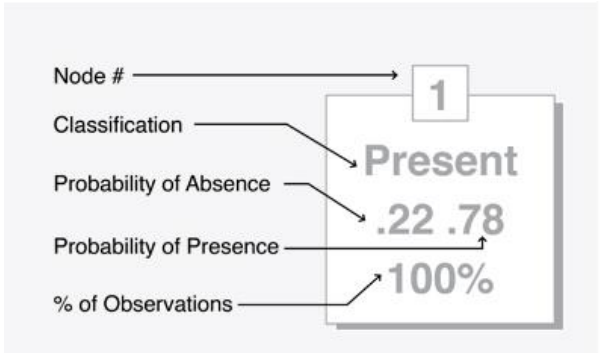
Results – The Big Picture

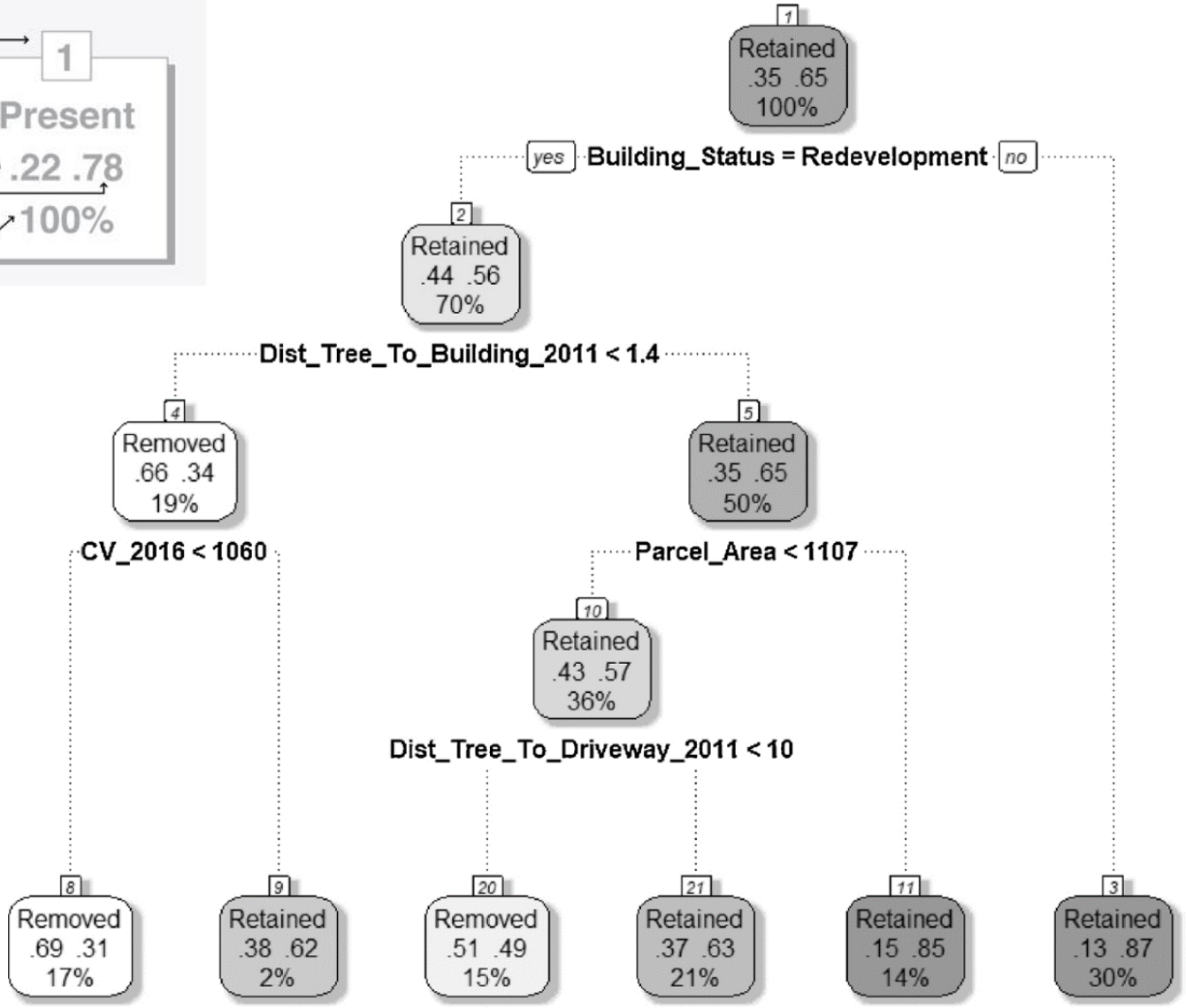
- 6,966 trees on 450 properties
- Redeveloped properties
  - 44% removal rate
  - 40.2% canopy cover loss
- Non-redeveloped properties
  - 13.5% removal rate
  - 12.8% canopy cover loss

Drivers of Tree Removal and Retention

Variable Name	Description
Resident and Household Variables	
Pop_Density_2013_MB	Continuous: Number of residents per square kilometre in 2013 on census tract level (per km^2)
Gender	Categorical: Gender of homeowner
Age	Continuous: Age of homeowner
Ethnicity	Categorical: Ethnicity of homeowner
Religion	Categorical: Religion of homeowner
SSQ	Categorical: Achieved secondary school qualification (Yes)/Without secondary school qualification (No)
PSSQ	Categorical: Achieved post-secondary school qualification (Yes)/Without post-secondary school qualification (No)
Economic Variables	
NZDep2013_MB	Continuous: Index of deprivation in 2013 on census tract level
CV_2016	Continuous: Capital value in 2016 (000 s NZD)
LV_2016	Continuous: Land value in 2016 (000 s NZD)
IV_2016	Continuous: Improvements value in 2016 (000 s NZD)
Household_Income	Categorical: Annual household income in 2016 (1000 NZD)
Spatial Variables	
Dist_Parcel_To_Reserve_2011	Continuous: Linear distance of property centre to the nearest greenspace (m)
Dist_Tree_To_Driveway_2011	Continuous: Linear distance of each tree crown boundary to the residential property's driveway (m)
Dist_Tree_To_Building_2011	Continuous: Linear distance of each tree crown boundary to the nearest building within the same residential property (m)
Land Cover Variables	
Parcel_Area	Continuous: Area of property parcel (m^2)
Building_Cover_2011	Continuous: Area of building footprint in 2011 to parcel area ratio (%)
Building_Cover_2015	Continuous: Area of building footprint in 2015 to parcel area ratio (%)
Impervious_Cover_2011	Continuous: Area of impervious ground cover (parcel area-hard and impervious area within a property) in 2011 to parcel area ratio (%)
Impervious_Cover_2015	Continuous: Area of impervious ground cover (parcel area-hard and impervious area within a property) in 2015 to parcel area ratio (%)
Building_Status	Categorical: Redeveloped building (Yes)/Non-redeveloped building (No)
Rd_Area_MB	Continuous: Road area on census tract level (m^2)
Rd_Cover_MB	Continuous: Road area on census tract level to census tract area ratio (%)
TreeC_2011	Continuous: Tree crown area in 2011 (m^2)
TreeH_2011	Continuous: Tree height in 2011 (m)
TreeV_2011	Continuous: Tree crown volume in 2011 (m^3)
TCC_2011	Continuous: Tree canopy cover in 2011 (%)

Modelling Tree Removal & Retention





Removal/Retention – Highlights

- Trees were:
  - > 3x more likely to be removed on redeveloped properties
  - ~ 3x more likely to be removed on smaller properties
  - ~ 2x more likely to be removed if close to building
  - 1.8x more likely to be removed on cheaper properties

Social and Demographic Influences

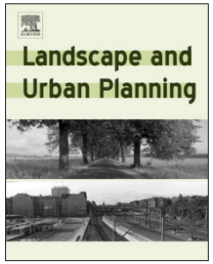
What led to owners' removal and retention decisions?

Landscape and Urban Planning 190 (2019) 103601

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan



Research Paper

To plant, remove, or retain: Understanding property owner decisions about trees during redevelopment

Tingdong Guo[a], Justin Morgenroth[a,*], Tenley Conway[b]

Methods

- Survey (n = 445) of redeveloped and non-redeveloped property owners

Socio-demographic characteristics of respondents and their property status based on questionnaires (n = 445).

Question	Level	Respondent (%)		2013 Christchurch Census Data[1] (%)	2013 New Zealand Census Data[1] (%)
		Redeveloped (n = 317)	Not Redeveloped (n = 128)		
Gender	Male	39	39	49	49
	Female	61	61	51	51
Age	Under 45	9	9	59	60
	45–65	46	50	26	26
	Over 65	44	41	15	14
Ethnicity[2]	New Zealand European	91	87	84	74
	Asian	1	0	9	12
	Māori	2	3	9	15
	Pacific Island	1	0	3	7
	Other	5	1	3	3
Religion[3]	No Religion	38	46	42	42
	Christian	60	52	44	49
	Other	2	2	4	8
Education Level	None	10	10	20	21
	Secondary School Qualification	20	27	40	40
	Diploma or Certificate	32	28	20	19
	Bachelor's Degree	26	14	14	14
	Post-graduate Degree	12	21	7	6
Annual Household Income (NZ $)	30,000 or Less	15	16	21	22
	30,001–70,000	19	31	32	32
	70,001–100,000	30	14	19	18
	100,001 or More	36	38	28	28

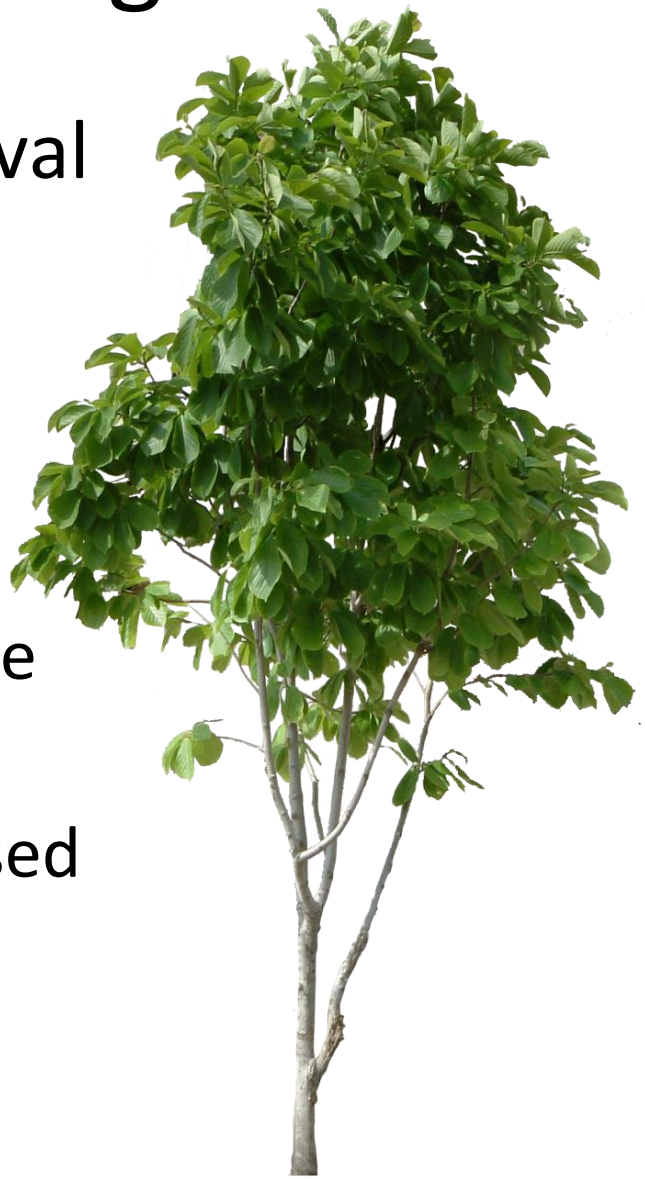
[1] Data derived from 2013 New Zealand Census (Statistics New Zealand, 2014).
[2] Data included those people who stated they belong to more than one ethnicity.
[3] 2013 Census data excluded object to answering, do not know, religion unidentifiable, response outside scope and not stated.

Tree Removal Survey Results

Reason	Overall (%)	Property Status (%)	
		Redeveloped	Not Redeveloped
Trees were in the way of demolition or construction vehicles or equipment*	68	83	20
Trees were removed to make space for the new development*	51	62	14
Trees were damaged, diseased or dead*	35	28	58
Tree roots damage drains, foundation or hard landscaping	10	9	12
Trees shade my garden*	9	6	19
Trees drop messy leaves, flowers, fruit or branches	9	8	11
Trees shade my house*	8	6	16
Trees interfere with underground or aboveground services	5	5	6
Trees were exotic or invasive species	5	4	7
Trees obscure my view	4	4	5
Trees require too much maintenance	4	3	6
Trees cause allergies or health problems	2	2	3
Trees promote criminal activities	1	1	0
Trees attract unwanted animals or insects	1	0	1

Tree Removal – Highlights

- Top reasons given for tree removal on redeveloped properties
  - 83% - Trees were in the way of demotion or construction vehicles or equipment
  - 62% - Trees were removed to make space for the new development
  - 28% - Trees were damaged, diseased or dead



Tree Retention Survey Results

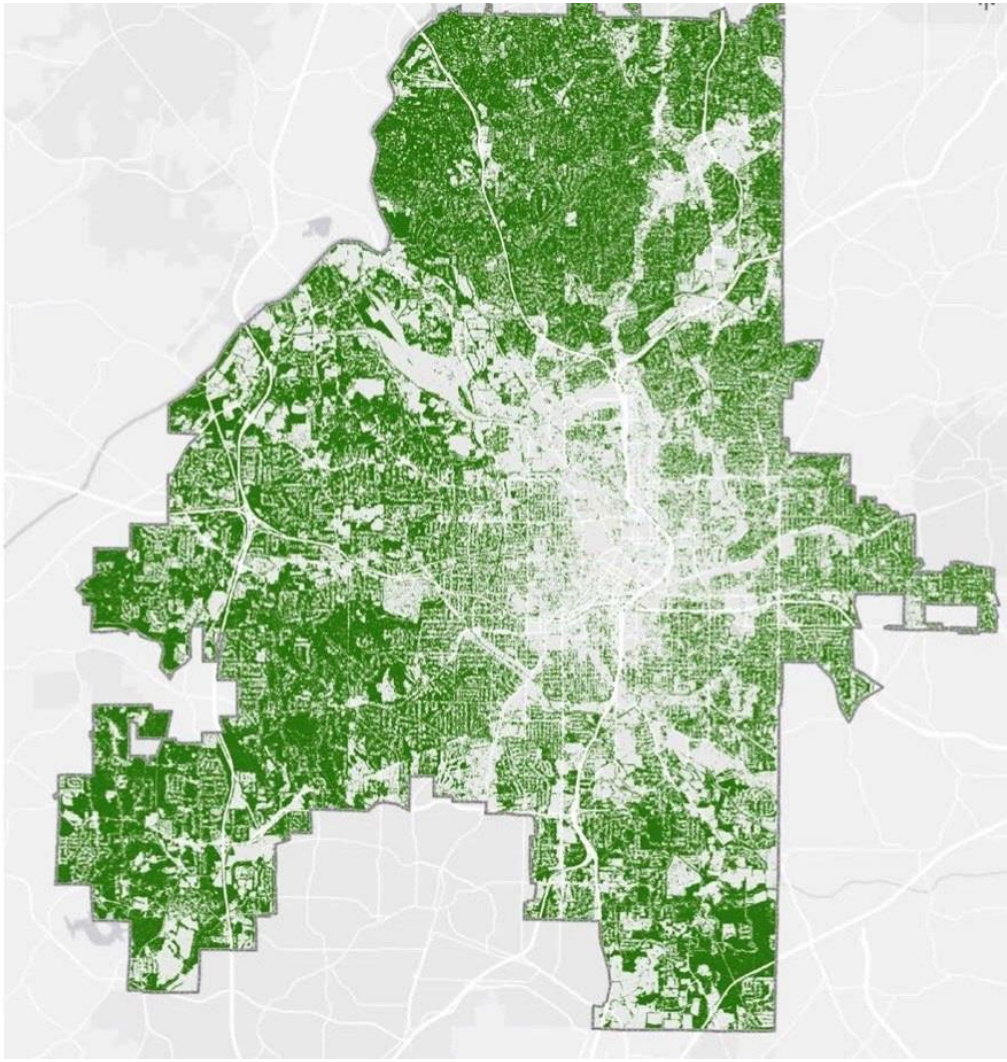
Reason	Overall (%)	Property Status (%)	
		Redeveloped	Not Redeveloped
Trees are aesthetically pleasing	89	89	90
Trees provide habitat for birds	81	79	86
Trees provide privacy	76	76	76
Trees provide shade	70	69	70
Trees improve air quality	58	59	57
Trees provide habitat for bees	54	54	56
Trees provide fruit or nuts	48	47	52
Trees increase property value	48	50	43
Trees stabilise the soil	45	44	46
Trees reduce noise	41	41	41
Trees are native species	32	31	35
Trees are culturally important	24	23	28
Trees celebrate a person or pet	17	17	16
Trees provide recreation potential	16	16	16
Trees reduce heating or cooling costs	11	12	8
High costs for removal	7	6	9
Government regulation prevents tree removal	3	2	4
Have not yet had time to remove	2	2	3

Tree Retention – Highlights

- Top reasons given for tree retention on redeveloped properties
  - 89% - Trees are aesthetically pleasing
  - 79% - Trees provide habitat for birds
  - 76% - Trees provide privacy
  - 69% - Trees provide shade

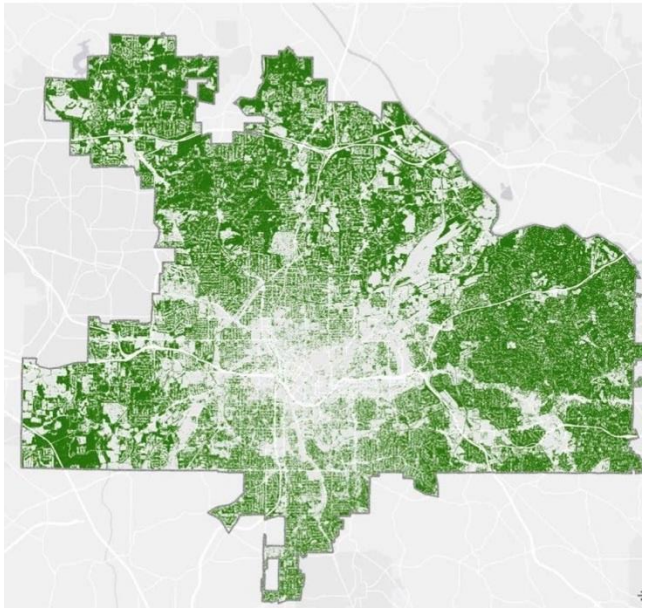
Implications

How do the results contribute to our understanding of redevelopment's effect on tree canopy cover?



Redevelopment's Effect on the UF

- Overall tree canopy cover declines after redevelopment due to loss of individual trees
  - May increase over time?
- Tree removal increased:
  - on smaller, cheaper properties, where trees were close to buildings → issues related to subdivision and infill housing?
- Despite acknowledging the ES of trees, owners removed them to meet development goals



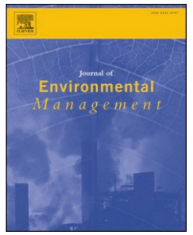
Redevelopment will continue in our cities.
How do we retain trees during redevelopment?

Journal of Environmental Management 285 (2021) 112081

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: http://www.elsevier.com/locate/jenvman



Research article

International approaches to protecting and retaining trees on private urban land

Camilo Ordóñez-Barona [a,*], Judy Bush [b], Joe Hurley [c], Marco Amati [c], Sirkku Juhola [d], Stephen Frank [e], Myles Ritchie [f], Christopher Clark [a], Alex English [g], Kelly Hertzog [h], Meg Caffin [i], Steve Watt [j], Stephen J. Livesley [a]

- Regulations and/or incentives
  - Policies, planning schemes, local laws, financial incentives, community engagement, and stewardship
- Benefits and drawbacks for each, but combination has potential to protect trees

Influencing Decision Makers

- Big changes with the potential to affect urban forests are made with surprising ease by decision makers
  - They want to solve problems and impress their constituents
- We can influence them with informed critique of gov't regulations

  - Requires urban forests have their own plans/policies/acts or that they be integrated into others
  - Requires regular monitoring
  - Requires people in influential positions

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